



## Reducing Turbine Mechanical Loads Using Flow Model-Based Wind Farm Controller

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*Publication date:*  
2017

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Kazda, J., & Cutululis, N. A. (2017). *Reducing Turbine Mechanical Loads Using Flow Model-Based Wind Farm Controller*. Poster session presented at Offshore Wind Energy 2017, London, United Kingdom.

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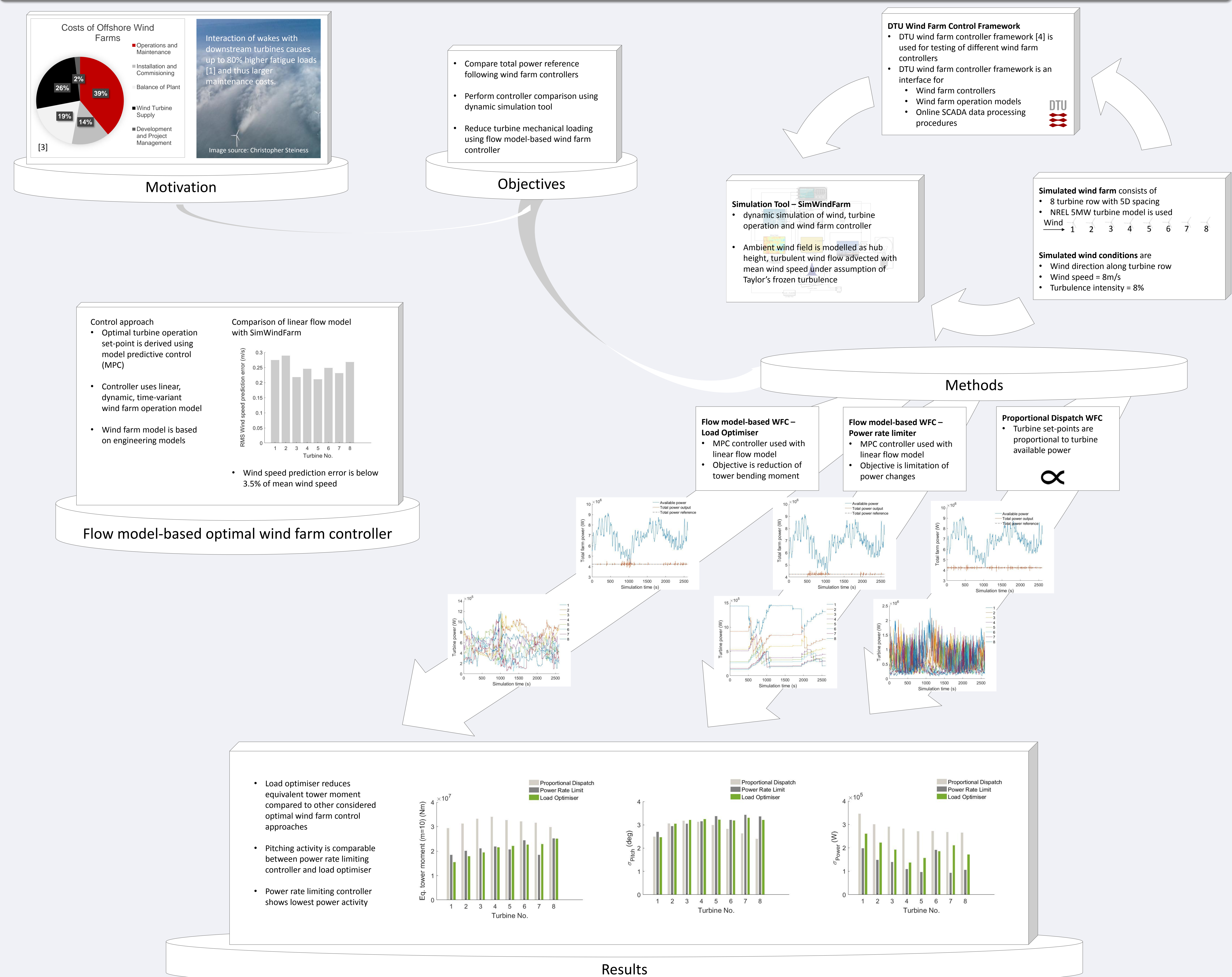
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## Abstract

Cumulated O&M costs of offshore wind farms are comparable with wind turbine CAPEX of such wind farm. In wind farms, wake effects can result in up to 80% higher fatigue loads at downstream wind turbines [1] and consequently larger O&M costs. The present work therefore investigates to reduce these loads during the provision of grid balancing services using optimal model-based wind farm control. Wind farm controllers coordinate the operating point of wind turbines in a wind farm in order to achieve a given objective. The investigated objective of the control in this work is to follow a total wind farm power reference while reducing the tower bending moments of the turbines in the wind farm. The wind farm controller is tested on a 8 turbine array, which is representative of a typical offshore wind farm. The operation of the wind farm is simulated using the dynamic wind farm simulation tool SimWindFarm [2]. SimWindFarm allows for the simultaneous simulation of the turbulent hub height flow field in the wind farm, the turbine dynamics and the wind farm control. The tests show a reduction of loads when compared to other optimal wind farm control approaches. Future work shall enhance the controller with more advanced turbine fatigue models in order to further improve the controller's performance.



## Conclusions

This work presents a case study of a newly developed, optimal wind farm controller. The objective of the control is to follow a power reference while reducing the loads of wind turbines in the wind farm. Simulation tests of the controller show a reduction of fatigue loading at downstream turbines when compared to other optimal wind farm control approaches. Future work shall enhance the controller with more advanced turbine fatigue models in order to further improve the controller's performance.

## Acknowledgements & References

This work is part of the CONCERT project, which is funded by Energinet.dk under the Public Service Obligation scheme (ForskEL 12396). Vattenfall R&D and Siemens Wind Power are acknowledged for their advice and data.

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